Day 2 Session 1: Outer Space for All

What does "ethical lunar exploration" mean to you? What should the community be thinking about moving forward?

"it means governed by a common framework of understanding - a code of conduct. the issue is how to monitor and ensure explorers to as best possible to follow the guidelines (legality, best will effort) - what are the consequences for explorers who step outside of the framework"

> "Related, a strong justice/enforcement system to be sure this is carried out, which can include cultural/societal enforcement"

"Private companies would not have the ability to make decisions that impact the entire planet"

"Peoples without space programs have a say in what is done to the Moon (all humans have a say). Consideration is given to future and past generations (again, all humans have a say)"

> "Related to this - ethical lunar exploration to me requires a greater diversity of people and views at the decision-making table."
>
> "Governments have signed agreements, but how does that affect private companies? I know there is one selling lunar burials already."
>
> "who / what agency or wider body is at or hosts the decision making table?"

"An agreement among those involved as to all parties' rights and responsibilities"

"Thinking about how lunar/space exploration is portrayed in the media and to the general public - right now the first word that comes to mind to most people outside the field is "space colonization" - we need to change this narrative first before we can start having ethical exploration! Echoing what Dr Billings just said"

> "Is there a better way to say "building human habitation" than using the word "colonizing"?"

"Decoupling exploration funding from Capitalism"

What measures (existing or new) can be taken to carry out lunar exploration in an ethical and responsible way?

"policy / frameworks cant be set by the US alone, as this wont achieve international consensus (the reason why some countries have not signed up to the Artemis accords). How many people here today are outside of the US to take part in this discussion / offer ideas... how does the NextGen / LunarList community diversify to bring more people from wider nationalities to the conversation?"

"Agreed! Unfortunately NextGen is majority US (though we have a couple of international students on the OC), I think spreading the word to other countries about these orgs is very important, and also valuing people's opinions from other countries! – Elisha"

"Careful consideration of how we name features on the Moon. Is it time to stop naming features after people?"

"Responding to Linda Billings' comment that early career people have many ideas related to inclusion and ethics, but they aren't in positions of power in order to enact change: How do we elevate people like this to positions of power? Many times there is no room for inclusion/ethics work as you get promoted, so people who care about these efforts either aren't elevated or choose not to pursue those paths."

"A Cultural Ethics Office at NASA? And a Tribal Relations Office."

> "Environmental and long-term conservation offices as well."

> "Key to engage with tribal partners treated as equals and with respect, hopeful a tribal relations office might accomplish it. Respect for what indigenous views bring and not the older approach of assimilation into our culture (even requiring them to relinquish/move away from their homes to participate in space exploration as professionals"

> "Historically, northern Arizona has also been a place where astronauts and planetary scientists train and not always with a clear discussion/inclusion of the significance of that landscape to indigenous people"

"Echoing James Lowenthal's idea that space (and the Moon etc) should be included under environmental protection. Spacecraft should undergo environmental impact testing prior to launch"

> "And as the upcoming Space X lunar impactor illustrates, better debris tracking beyond the current boundaries is very important." *[note: this refers to the booster impact thought to be from a SpaceX/NASA launch at the time of the workshop, more recently thought to be a CNSA launch]*

"Aparna's comment: "Can we be the elders the future deserves?" is a really key concept to think about."

Other Reflections

"how can we best honor the cultural value of the Moon through new agreements, space law and space policy?"

"I wanted to raise the growing need for legal clarity around how we honor (in space or the Moon) the existing treaties with sovereign Indigenous nations on Earth. This will become a huge issue very soon, esp around issues that have had a painful history on Earth (e.g. mining)"

"I just really want to remember this lovely quote from Aparna Venkatesan "the wild and merry journey our atoms have been on""

"whether the idea of progress is a Christian one or not, I caution against using these kinds of labels in a negative context, especially in an inclusivity-focused meeting. Christianity is another belief system that should be welcomed alongside all of the others, whether you agree with it or not."

> "Thanks for this sharing this reflection in a thoughtful way. I was thinking something similar, so appreciate it being brought up."

""Space and the night sky are part of the environment" I definitely don't think about this fact as much as I should."

Day 2 Session 2: Technical Challenges and Solutions

What scientific or technical challenges do you think are most important to address to enable responsible lunar exploration?

"Ability to reuse/maintain existing equipment (dust, UV exposure, etc.)"

> "And Karl's point of using the "remains" from extraction processes in other applications like construction."

> "With the nearest hardware store quite far away, the motto should be trying to reuse or repair as much as possible. Interoperability and standarization play into this."

"Also thinking about debris that is going to be produced (instruments that break, finished missions and the corresponding spacecrafts,...) and how to either recycle it or where to dispose it"

"Perhaps what we learn about recycling and reusing in the context of ISRU on the Moon can be used to our benefit for recycling and responsible resource (re)utilization here on Earth"

"Near-surface lunar magnetic environment is not well characterized, engineering challenge + human health implications"

"It is impossible to responsibly manage a resource you don't understand. Lunar ice falls in the "we don't understand" category."

> "Until this SBIR solicitation I had rarely seen non-water volatiles mentioned so I believe we are at least moving towards discussion which should help with understanding what we see on the surface."

"Understanding resource renewability and long-term viability (related to Jessica's question in WebEx)."

"Understanding what resources actually exist on the Moon"

"Developing long-term environmental monitoring stations."

"Impacts of arriving/departing landers on the environment and emplaced assets. Is it better to use more small landers or fewer large landers to deliver the same mass."

What aspects of the lunar environment do you think are most important to keep in mind when planning for responsible lunar exploration?

"A sustained human presence in such an extreme, hostile environment will create emergencies. Having flexible resources and personnel will be required for overcoming unknown unknowns."

"From Dr. Levine's talk: We need to monitor the lunar exosphere to understand how we impact it with exploration"

"Understanding what changes are reversible and what are permanent."

> "Especially with regards to surface/subsurface volatiles that could be inadvertently lost to space with frequent landings"

> "Changes may not just include losing volatiles from the regolith due to exploration activities, but also adding them/contaminating the naturally-occurring volatiles. This will have implications for science."

> "I also wonder about permanent changes to the uppermost regolith."

"Paraphrasing Brian: waste management practices"

"Inadvertent (or intentional) biological contamination of the lunar surface"

"effective recycling processing"

"the scale of human activity compared to natural processes or visible from Earth"

"Including indigenous voices when it comes to resource usage and recycling"

> "as well as international voices and not just from the largest and most powerful nations"

"See ESA's Moon Village, which aims to be inclusive of all nations, and the Moon Village Association, an international NGO that aims to include all nations in lunar exploration and settlement. https://moonvillageassociation.org/"

Other Reflections

"Thinking aloud... What order do we do things in, and what does that say about us? e.g. Do we need to understand a resource before planning how to use it? Or should we be doing both at the same time?"

"I sometimes worry that return to the Moon plans are mooving too fast, without enough long-term thinking..."

"Who decides what changes to the Moon are appropriate and which should be avoided?"

Day 2 Session 3: Accountability and Ethical Exploration

What socioeconomic or policy challenges do you think are most important to address to enable responsible lunar exploration? How can the lunar community support policy-making processes?

"Environmental Impact Assessments as a norm."
"In terms of policy, trying to move toward demilitarization of space law/policy, this will make space more accessible (less ITAR restrictions) and hopefully change the narrative from fronterism to community"

"Who are the stakeholders? How to we identify/define/include them?"

"need some way to protect against decisions that are simply driven by finance / profit"

What would an ethical and responsible future human relationship with the Moon look like, in your view?

"One in which we consider not just economic implications of our actions, but also societal and cultural implications."

"Applying lessons learned from our relationship with Earth to the Moon!"

"Treating the Moon like we treat National Parks"

> "But also being mindful of the history of National Parks in the US."

> "And/or national forests that are slightly less restrictive"

> "How do we do this multilaterally?"

> "On an earlier board, someone mentioned the long-term "regrowth" of sorts. While regrowing regolith and craters isn't really feasible, how should the "national forests" be left once utilized."

"One framework for the ethical use of the Moon: balance Fortitude, Prudence, Justice, and Temperance.

Fortitude: Space if hard. There is real risk to life and wealth in exploring the Moon. The risk falls disproportionatly on a few (astronauts foremost, taxpayers of spacefaring countries to a lesser extent (I would put commercial entities on this list, but it is not clear they really are undertaking much real risk under programs like CLPS)). This should not be lost in all the other valid points.
Prudence: The risk of exploring the Moon must be understood and carefully managed. Wasting life and wealth (especially not your own) is unacceptable. Exploration's negative consequences should not outweigh the benefits. A few examples of negative consequences: ruining the beauty of the Moon, destroying deposits of unique scientific value, or desecrating sacred sites.
Justice: Many aspects to this. On the one side, the benefits of exploring the Moon should be proportional to the risk taken. But there need to be real negative consequences to acting imprudently.
Temperance: Only use what you really need, not grab everything you can."

"Thinking about the COSPAR talks and their point that they are not intending to prohibit science: you will never be able to make everyone happy, but that shouldn't mean that you just ignore all of the ethical implications. I hope we can find a good solution for the disconnect between needing to go slowly and thoughtfully to consider all perspectives versus the "full steam ahead" model we are currently in for lunar exploration."

> "perhaps the link is something like social license to operate"

"think missions through before starting them. From start to the end, including (as mentioned before) using resources efficiently, recylcle as much as possible, think about debris disposal. Also think of future missions and how to minimize negative impact on each other (international cooperation on the lunar surface although not all missions are cooperations)"

Other Reflections

"Not sure what session / question this is best address in, but part of environmental sustainability also needs to include any consequences for the Earth / climate because of the production of space exploration equipment."

"Similar to points brought up in yesterday's sessions: how can we prioritize these things which are intangible (or whose benefits are intangible) and are therefore often categorized as "non-essential" (or are de-prioritized)?"

"Aparna Venkatesan: "Does [mining] benefit most or all of humanity, or reinforce existing power/economic gradients?""

"Learning so much from Kathryn Hadler's talk!"

> "And all the talks!"

"Curious if there are less comments on this Miro compared to the others due to us having more questions than answers or directives on this topic."